

Definition and location of the *Banksia* woodlands

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A recent book (Pate & Beard 1984) entitled *Kwongan: the Plant Life of the Sandplain* dealt with the vegetation of sandplains in the Extra-Dry Mediterranean Bioclimatic Zone (Pate & Beard 1984) on which kwongan is the characteristic plant formation. *Banksia* woodland (technically *Banksia* low woodland) is the characteristic formation of sandplains in the more humid Dry Mediterranean Bioclimatic Zone where the length of the dry season averages 5-6 months as against the 7-8 months of the Extra-Dry Zone. *Banksia* woodland may be said to represent the plant life of the sandplain within this bioclimatic zone, which corresponds to the Darling Botanical District. Deep well-drained sandy soils form the characteristic habitat for *Banksia* woodland, and these occur principally within the Drummond subdistrict, which includes the Swan Coastal Plain and the Dandaragan Plateau.

Area calculations from the Vegetation Survey of WA (Beard & Sprenger 1984) estimate that *Banksia* low woodland originally covered 6 229 km² of which 61% is now alienated land where the vegetation is presumed cleared. *Banksia* woodland with scattered emergent eucalypts is estimated to have covered a further 680 km², all of which is now on alienated land. The amount of remnant vegetation on alienated land is not known.

The woodland is dominated by small trees of about 6-8m among which *Banksias* are the most numerous. On the Swan Coastal Plain these are *B. attenuata*, *B. menziesii*, less commonly *B. ilicifolia*, together with *Eucalyptus todtiana* and *Nuytsia floribunda*, and in the southern part *Casuarina fraseriana*. Further inland, in the northeastern occurrence on the Dandaragan Plateau, *B. menziesii* is replaced by *B. burdettii* and *B. prionotes*, while *Actinostrobos arenarius* and *Xylomelum angustifolium* also join the assemblage. Leaves of the *Banksias* are 10-15 cm long, rough, chartaceous, serrate; though large, they are relatively few so that the crown is thin, and branching of the trees is somewhat open. Bark is very thick, dark, scaly. The formation resembles the oak (*Quercus*) woodlands of other mediterranean regions, in particular the cork oak (*Q. suber*) woodlands of the mediterranean itself. Individually, *Banksias* resemble *Curatella americana* of savannas in tropical America, which significantly is named *chapparro*, Spanish for cork oak. Some convergence in evolution is perhaps impressed by the poor siliceous sands in these cases.

The *Banksia* woodlands have a well developed sclerophyll shrub understory for which Speck (1952) listed 28 spp of tall shrubs, 130 of low shrubs, and 182 spp of ground-layer plants including many Restionaceae, Cyperaceae and other herbaceous monocots, for the woodlands on the Swan Coastal Plain. Speck indicated for each of these components whether it occurred on limestone (i.e. on the Spearwood Dune System), on Bassendean sand or in a so-called "Moist Phase" which describes swampy areas which may be present throughout. These are the three most readily recognizable substrate types within the *Banksia* woodlands of the Plain.

Prior to Speck's detailed study, the *Banksia* woodlands had received scant attention in the literature. Diels (1906) did not recognize this formation precisely. The vegetation of the Bassendean sand was treated as "Mixed woodlands of the Coastal Plain" with emphasis on *Eucalyptus marginata* and *Casuarina fraseriana*. However Diels named the component *Banksia* spp (*B. attenuata*, *B. menziesii* and *B. ilicifolia*) as "several *Banksia* species which as smaller trees or tall-growing shrubs characterise many places in these woodlands of the plain" (p 228).

Gardner (1944) made no mention at all of these woodlands but as his treatment of the vegetation of the State was much briefer than Diels', it was necessary to omit describing many of the less extensive communities.

Subsequent to Speck's work, Havel (1968) published a study of the understory communities of the *Banksia* woodlands found in State Forest No. 65, employing mathematical analysis which distinguished 11 understory groupings associated with particular site conditions. 5 of these occurred on the Spearwood Dune System, 3 on the Bassendean System, 1 on the transition between the two, and 2 on swampy sites which might occur throughout the area, thus confirming Speck's earlier habitat divisions.

Subsequently again, Speck's work was summarized by Seddon (1972) together with a vegetation map scale 1:500 000 of the Swan Coastal Plain from the Moore to the Murray River, distinguishing 11 units. In 1979 as part of the System 6 study, Heddl published a vegetation map scale 1:400 000 covering the same part of the Swan Coastal Plain and extending further inland. F G Smith mapped vegetation in detail at 1:250 000 on the Busselton-Augusta sheet in 1973 and the Collie sheet in 1974. My own mapping at this scale of the Moora/Hill River, Perth and Pinjarra sheets was published in 1979. A composite map from these sources showing the extent of the *Banksia* woodlands is shown in Fig 1.

The mapping shows that *Banksia* woodland, while generally considered typical of the Swan Coastal Plain, is by no means confined to it. A substantial area, perhaps one third of the whole, occurs on the Dandaragan Plateau. There are even some minor occurrences east of the Darling Range. All these occurrences are within the Darling Botanical District. *Banksia* woodland occurs throughout the length of the Swan Coastal Plain, a distance of some 400 km north to south. Rainfall and temperature as well as soil and topography vary throughout this range, so that the distribution of the woodlands varies from point to point.

Banksia woodland reaches an optimum on the Plain between Muchea and Cataby, declining in both the northerly and southerly directions. In this central node it extends west onto the Spearwood Dune System and even reaches the sea in several places. It forms almost the total vegetation of the Plain here and extends widely over the Dandaragan Plateau immediately to the east. North of the central node the *Banksia* woodland is affected by declining rainfall so that it becomes restricted to the deeper sands. It is replaced by kwongan on the coastal limestone, and on the Dandaragan Plateau also except for a large extension from Moora to Watheroo. On the Coastal Plain the *Banksia* woodland finally pinches out near Jurien. The decline of the *Banksia* woodland is a gradual process and in many places there is a continuum from the woodland into *Banksia*-dominated kwongan which is much lower and more open than the woodland proper. In mapping in such cases one has to exercise a subjective decision and to decide somewhat arbitrarily where a boundary should be drawn. This applies particularly to the northern limit of inland *Banksia* woodland about the middle of the Watheroo National Park.

In a southerly direction the *Banksia* woodland is affected by increasing rainfall, the appearance of heavier soils, and of frequently more swampy conditions. South of Yankep, tuart and tuart with jarrah form taller eucalypt woodlands on the coastal limestone. The *Banksias* persist as an understory. On the inland side of the Swan Coastal Plain south of Gingin there are heavier

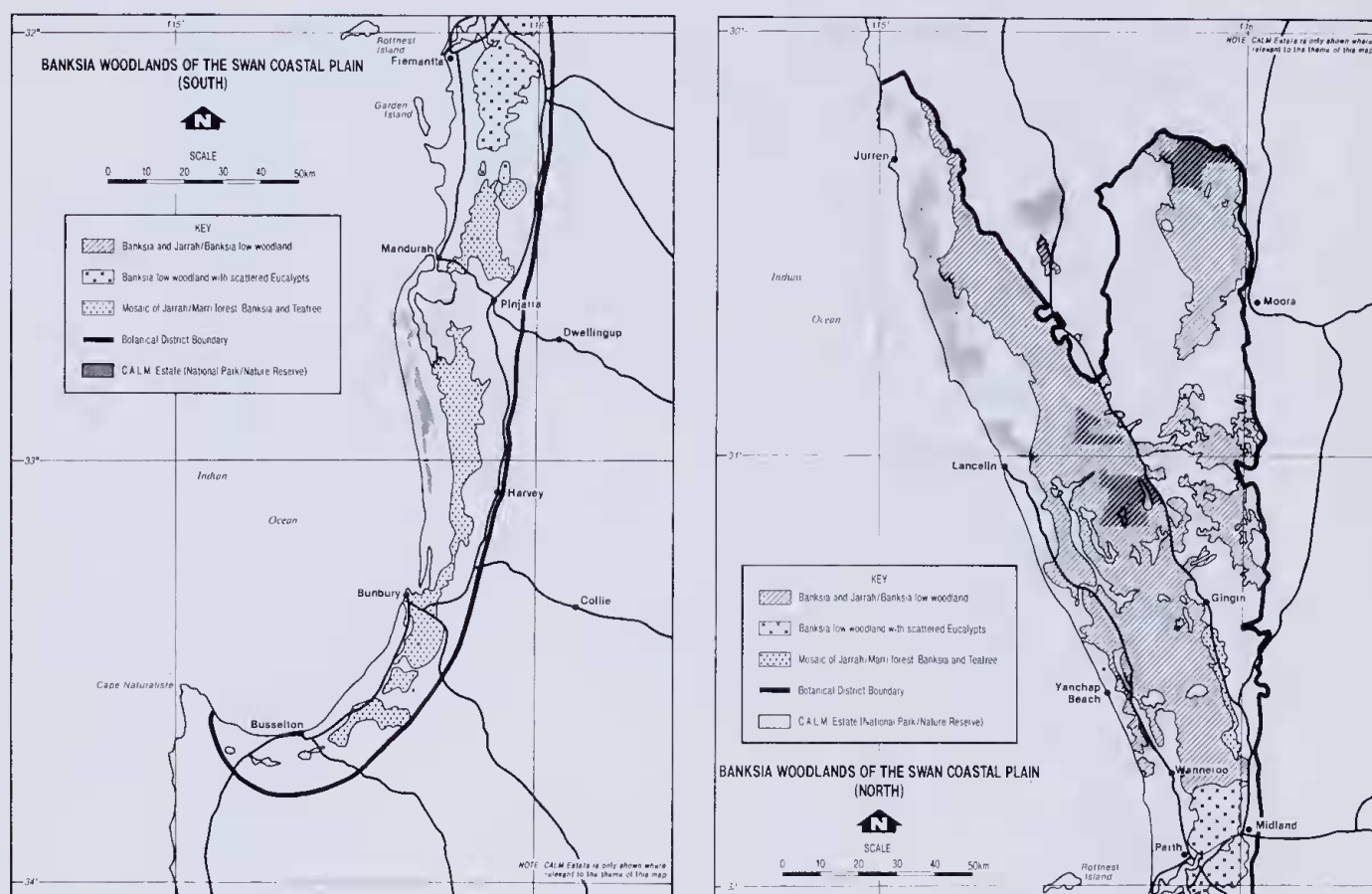


Figure 1 Distribution and extent of *Banksia* woodlands in southwestern Australia.

soils under jarrah-marri woodland and a swampy belt which has (or used to have before clearing) a mosaic of eucalypt woodland, *Banksia* woodland, paperbarks and *Casuarina obesa*.

South of Wanneeroo the *Banksia* woodland, which has already acquired *Casuarina fraseriana* as a co-dominant since north of Yancheep, is further joined by scattered larger emergent jarrah trees, a structural type separately mapped. This occurs also at the southern extremity of the Dandaragan Plateau. At Wellard opposite Rockingham the last of the extensive stretches of *Banksia* woodland comes to an end, pinched out by the heavier soils at the foot of the escarpment and the increasing wetness of the Plain. From here southward the *Banksia* woodland forms a component of a tripartite mosaic with eucalypt and paperbark woodlands, or occurs as occasional patches within predominant eucalypt woodland. This situation is modified only in the extreme south where jarrah-marri forest (rather than woodland) is believed to have been the principal vegetation of the Coastal Plain. There are still some specific patches of *Banksia* on former coastal dunes, including one patch outside the Coastal Plain.

Along the south coast from Cape Leeuwin east to Albany a different bioclimatic zone is entered, the Mesomediterranean where the dry season is shortened to 3-4 months. *Banksias* continue of course to occur but mainly as components of other vegetation. *Banksia* woodland as such may occur on limited areas of well-drained sand forming an intermediate belt between jarrah forest and swamps, or on low sandy ridges rising from swamps (F G Smith 1972). Small patches of typical *Banksia* low woodland have been recorded in the Narrikup area (Beard 1979d). Apart from these instances sandy habitats are otherwise occupied. On south coast dunes *Agonis flexuosa* occurring in forms

from mallee to well-grown trees is the dominant species, rather than *Banksias*. Outwash plains of white sand carry *Casuarina fraseriana* low forest in pure stands or mixed with *Eucalyptus staeri* if there is poor drainage. A novel *Banksia* community in this region however consists of *B. verticillata* forming low forest under swampy conditions.

Further to the east there is a transition to kwongan as there is in the northern sandplains with *Banksias* continuing as a conspicuous element on deeper sandy soils as far east as Israelite Bay.

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